Research News

'Self-healing' phenomena found in solar cell material

THE ability for 'self-healing' has been identified in copper indium gallium selenide, a discovery that may help create better solar cells and other electronic devices.

An international team, consisting of researchers from Israel's Weizmann Institute and Tel Aviv University, as well as colleagues from France's CNRS and Germany's Stuttgart University, discovered the phenomena when examining the unusually high stability of $Cu(In,Ga)Se_2$. This stability has long baffled the scientific community as the complexity of the material suggests that it should be easily disrupted, yet it manages to survive intact for long periods under harsh conditions, including those present in space.

Their discovery is based on studies of the related material, copper indium diselenide (CIS), using the European Synchrotron Research Facility in Grenoble, France. The researchers found that in some cases the bonds between certain atoms of CIS can be broken relatively easily and that that Cu atoms can move inside these semiconductor crystals, an unexpected finding for a stable semiconductor.

Another even more surprising finding provided the explanation for the material's mysterious stability. Once some atomic bonds have been broken, the Cu atoms, which are capable of moving throughout the crystal, wander around until they reach the damaged spot and undo the effects of the damage. This 'self-repair' mechanism stems from the material's tendency to try and stay close to equilibrium. "Now we understand how solar cells made of $Cu(In,Ga)Se_2$ manage to survive and function effectively in hostile environments such as those encountered on satellites - once damaged, for example by radiation, this 'smart' material simply 'heals' itself and restores its previous function," Prof. David Cahen of the Weizmann Institute says.

The research, presented in June at the 'European Materials Research Conference' in Strasbourg, France, and soon to be published in *Advanced Materials*, may lead to more extensive use of $Cu(In,Ga)Se_2$ and help design other self-stabilizing materials.

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Laser News

Oxide technology enhances VCSELs

AN oxidation process developed at the University of Illinois (Champaign, IL, USA) is set to play an important role in the fabrication of VCSELs.

The power of the process, according to Prof. Nick Holonyak Jr, is its ability to selectively oxidize layers of AlGaAs buried deep within the device structure, creating an insulating 'collar' around a VCSEL's conducting cavity.

"The oxide collar very effectively defines the electromagnetic field and confines the current within the aperture," Holonyak said. "The collar also controls the geometry of the optical beam, making it easier to couple the light into optical fibers for data transmission." This allows the production of small, efficient and high performance VCSELs. The oxidation process was discovered by accident in 1989, when Holonyak and graduate student John Dallesasse were investigating the effects of moisture degradation on AlGaAs. By subjecting the crystals to temperatures of 400°C and high humidity, they crossed a phase boundary where the chemistry created a smooth, solid oxide.

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Briefs...Briefs...

Promecome Electronics (Paris, France) has launched a range of low alpha emitter (U, Th: guaranteed below 1 ppb) content Al 6N5 MBE grade ingots with very low Si, Fe, Ga and Cu content. Sizes available include 6 mm dia x 20 mm long (1.5 g) and 10 mm dia x 40 mm long (8.5 g).

Hittite Microwave Corp (Woburn, MA, USA) will add selected MMIC die from **United Monolithic Semiconductors** (Orsay, France) to its recently introduced Surface Mount Ball Grid Array (SMT BGA) packaged MMIC product line. These new products will address point-to-point/multi-point, LMDS, VSAT/USAT, and LEO/MEO satellite telecom applications.

SLI Inc (Canton, MA, USA) and **Stanley Electric Co** (Tokyo, Japan) have formed a joint venture to establish a North American manufacturing plant for the production of surface mount (SMD) LEDs (light emitting diodes). SLI, Inc will have a 70% ownership position in this manufacturing joint venture.

TRW Inc (Redondo Beach, CA, USA) is to produce a set of InP chips designed by the Australian government-owned Commonwealth Scientific and Industrial Research Organisation (CSIRO). The contract will run for 24 months and is worth about US$600 000.